

INCH-POUND

MIL-DTL-55181D

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SUPERSEDING

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## DETAIL SPECIFICATION

### CONNECTORS, PLUG AND RECEPTACLE, INTERMEDIATE POWER (ELECTRICAL, WATERPROOF), TYPE MW, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments  
and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers a series of center-lock coupling screw waterproof, polarized, multicontact, intermediate power connectors for (Type MW) for interconnection of power and control circuits on electronic equipment (see 6.1).

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

##### 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: VAI, 3990 East Broad Street, Columbus, Ohio 43216-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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### SPECIFICATIONS

#### DEPARTMENT OF DEFENSE

MIL-F-14072 - Finishes for Ground Based Electronic Equipment.

#### FEDERAL

FED-STD-H28 - Screw-Threads Standards for Federal Services.

### STANDARDS

#### DEPARTMENT OF DEFENSE

MIL-STD-202 - Tests Methods for Electronic and Electrical Component Parts.  
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.  
MIL-STD-889 - Dissimilar Metals.  
MIL-STD-1285 - Marking of Electrical and Electronic Parts.  
MIL-STD-1344 - Test Methods for Electrical Connectors.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D, Customer Service, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

### DRAWINGS

#### ELECTRONIC COMMAND

SC-A-46439 - List of Accessories for Package Tester.

(Unless otherwise indicated, copies of the above specifications, standards, and drawings required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the procuring activity or as directed by the contracting officer. Both the title and number or symbol should be stipulated when requesting copies.)

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

### ASTM INTERNATIONAL

- ASTM A582/A582M -Free Machining Stainless and Heat Resisting Steel Bars.
- ASTM B16 - Rod, Bar, Free Cutting, Bar and Shapes for use in Screws.
- ASTM B139 - Rod, Phosphor Bronze, Bar, and Shapes.
- ASTM B194 - Copper Beryllium Alloy, Plate Sheet, Strip, and Rolled Bar.
- ASTM B196 - Rod and Bar, Copper Beryllium Alloy.
- ASTM B488 - Gold for Engineering Uses Electrodeposited Coatings of.
- ASTM D2000 - Rubber Products in Automotive Applications.
- ASTM D5948 - Compounds, Molding, Thermosetting.

(Application for copies should be addressed to the ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

### AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

- ANSI Z540.1 - Laboratories, Calibration, and Measuring and Test Equipment.

(Application for copies should be addressed to the American National Standards Institute, 25 West 43<sup>rd</sup> Street, 4<sup>th</sup> FL., New York, NY 10036.)

### INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO-10012-1 - Equipment, Metrological Confirmation Systems for Measuring.

(Application for copies should be addressed to the International Organization for Standardization, 1 Rue De Varembe, Case Postale 56, CH-1211 Geneva 20, Switzerland.)

### SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE-AMS-QQ-N-290- Nickel Plating (Electrodeposited).
- SAE-AMS-QQ-P-35 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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## 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Connectors furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.7 and 6.3).

3.3 Materials. Example reference materials are identified herein. However, when an example reference material is not identified, a material shall be used which will enable the connectors to meet the performance requirements of this specification. Acceptance or approval of a constituent material shall not be construed as a guaranty of acceptance of the finished product.

3.3.1 Reference materials, plating, and processes. The identified reference material, plating, and processes have been established to provide assurances that connectors manufactured to this specification will properly interface to similar industry standard or government specified connector systems without problems of electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products. The manufacturer of connectors supplied to this specification is allowed to use alternate recognized industry standard materials, plating, and processes from those identified in 3.3 of this specification. Alternate materials, plating and processes used must be coordinated with the qualifying activity as part of the qualification process. Use of alternates to those referenced guidance items by the supplier must not result in inferior short or long term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, plating, or processes. Short or long term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

3.3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3.3 Metals and finishes. All exposed metal parts, other than electrical contacts, may be aluminum, aluminum alloy, brass, steel or corrosion resistant steel. Where dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. Dissimilar metals such as brass, copper or steel (except corrosion-resisting steel), shall be passivated in accordance with AMS-QQ-P-35 (see 3.3.3.1) and shall not be used in intimate contact with aluminum or aluminum alloy.

3.3.3.1 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metals, which in contact, tend toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum and aluminum alloy) is not acceptable (see 3.3.1). For guidance, reference MIL-STD-889.

3.3.4 Insert material. Insert material shall be in accordance with ASTM D5948, diallyl ortho-phthalate, type SDG-F, or GDF-30F.

3.3.5 Rubber. Rubber material shall be in accordance with ASTM D2000.

3.3.6 Contacts.

3.3.6.1 Contact outer sleeve (pin and socket). The sleeve of the pin and socket shall be made of brass in accordance with ASTM B16.

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3.3.6.2 Male contacts. Male contacts shall be made of brass in accordance with ASTM B16.

3.3.6.3 Female contacts. Female contacts shall be of the closed entry type. The spring contact portion of the socket shall be beryllium copper in accordance ASTM B139, ASTM B194, or ASTM B196.

3.3.6.4 Electrical contact plating. Electrical contacts shall be gold plated in accordance with ASTM B488, type II, code C, class 1.27 (50 microinches) minimum thickness.

3.3.6.5 Contact finish. All contact finishes shall have an underplate of nickel in accordance with AMS-QQ-N-290, class 2, 30 microinches to 150 microinches (0.00076 to 0.0038 mm) thick. Silver shall not be used as an underplate.

3.3.7 Nose piece. The nose piece shall be hardened alloy steel capable of meeting the requirements of this specification.

3.3.8 Jack screw and handle. Jack screw and handle shall be stainless steel, class 303, condition A, in accordance with ASTM A582.

3.3.9 Finish. Finish on exposed surfaces shall be dull olive drab finish M-225 in accordance with MIL-F-14072, except stainless steel jackscrew and handle assembly.

3.3.10 Fungus resistance. Finishes and materials used in the construction of connectors shall be fungus inert in accordance with MIL-STD-810, method 508.5, amount of growth none, rating 0.

3.3.11 Threaded parts. Unless otherwise specified (see 3.1), all threaded parts shall be in accordance with FED-STD-H28.

3.4 Design and construction. Connectors shall be of the design, physical dimensions, and construction specified to withstand the handling and maintenance expected in installation and normal service use and to comply with the requirements specified herein (see 3.1).

3.4.1 Casting and molded parts.

3.4.1.1 Casting. Castings shall be of uniform quality and conditions, and free from harmful cracks, shrinkage, porosity, gas holes, foreign matter, and other injurious defects. The surface of the castings shall be free from pits, porous areas, fins, ridges, modules, raised metal, and scale. All castings shall be completely cleaned prior to presentation for inspection. Castings shall not be plugged or welded, nor shall imperfections be filled in. Parting lines, gates, and vents shall be neat and clean and present a good workmanlike appearance.

3.4.2 Molded parts. Molded parts shall be uniform in quality, condition, and color. The molded parts shall be clean, smooth, and free from porous areas, foreign materials, weak sections, bubbles, flash, and any other detrimental defects. Inserts shall be designed with suitable sections and radii such that will not readily chip, break in assembly or in normal use. The contact retaining system shall be free of foreign material, adhesive, or any obstruction that would prevent smooth contact insertion and positive retention.

3.4.3 Contact arrangements. Contact arrangements in inserts shall be as specified (see 3.1).

3.5 Interchangeability. The mated connectors and individual plugs and receptacles having the same Part or Identifying Number (PIN) shall be directly and completely interchangeable with each other with respect to installation and performance, as specified herein, and the applicable specification sheet (see 3.1).

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3.6 Performance. The connectors shall be designed to meet the performance requirements specified herein.

3.6.1 Dielectric withstanding voltage. There shall be no arcing, dielectric breakdown, or damage when the connectors are tested in accordance with 4.9.3. The altitudes and corresponding test potentials shall be as specified in table I.

TABLE I. Test voltages, ac, rms.

Altitude (feet)	12 AWG contacts (volts)	20 AWG contacts (volts)
Sea level	2,000	1,500
50,000 (15.24 Km)	750	500

3.6.2 Insulation resistance. When tested as specified in 4.9.4, the insulation resistance shall not be less than 1,000 megohms.

3.6.3 Air leakage. When tested as specified in 4.9.5, the connectors (plugs and receptacles) shall be capable of withstanding an air pressure of 2.5 psi (10.24 kPa) when applied to the contact face and then to the rear of the plug or receptacle without leakage developing through the body.

3.6.4 Interchangeability. When tested as specified in 4.9.6, like units, assemblies, and subassemblies shall be physically and functionally interchangeable, without modification of such items or of the connector. Individual items shall not be handpicked for fit. Reliance shall not be placed on any unspecified dimension, characteristics, etc.

3.6.5 Contact resistance. When connectors are tested in accordance with 4.9.7, the voltage drop across the mating contact terminals shall not exceed 20 mV (millivolts).

3.6.6 Humidity. Mated and unmated connectors shall be subjected to the test specified in 4.9.8. Following the test, the connectors shall meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

3.6.7 Insert strength. The connectors shall be capable of withstanding the force specified in 4.9.9 without the inserts cracking, breaking, or the center lock nut rotating, or breaking loose from the insert.

3.6.8 Contact retention. The individual contacts shall be capable of withstanding an axial load of 10 pounds (4.54 kg) minimum when tested in accordance with 4.9.10.

3.6.9 Temperature cycling. During the fifth cycle of the test specified in 4.9.11, the connectors shall be capable of being mated and unmated. Following the test, the connectors shall meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

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3.6.10 Durability. The connectors shall be capable of withstanding the test specified in 4.9.12 without showing evidence of:

- a. Uneven wear on engaging hardware.
- b. Uneven wear, galling, or removal of plating on contacts.
- c. Free metal chips in the contact area.
- d. Displaced, bent, or broken contacts.
- e. Pierced or broken inserts.
- f. Wing blade shall not loosen, change shape, or be otherwise damaged.

Following the test, the connectors shall meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

3.6.11 Impact resistance of nosepiece. The connectors shall be capable of being mated and shall show no physical damage after being subjected to the test specified in 4.9.13.

3.6.12 Vibration. When mated connectors are tested as specified in 4.9.14, there shall be no evidence of cracking, breaking, loosening of parts and the plug shall not become disengaged from the receptacle. Following the test, connectors shall meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

3.6.13 Salt spray (corrosion). When connectors are tested as specified in 4.9.15, unmated connectors shall show no exposure of base material due to corrosion, which will adversely affect performance, and there shall not be sufficient corrosion to interfere with mating or unmating the connectors.

3.6.14 Immersion. When test as specified in 4.9.16, the connectors shall meet the requirements of insulation resistance of 3.6.2, and there shall be no evidence of water in the connector.

3.6.15 Bounce. After being tested as specified in 4.9.17, there shall be no evidence of loose parts or physical damage other than surface abrasions. Following the test, the connectors shall meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

3.6.16 Drop. After being tested as specified in 4.9.18, the connectors shall show no evidence of cracking, breaking, or loosening of parts. Following the test, the connectors shall then meet the following electrical requirements; dielectric withstanding voltage (sea level) (3.6.1), insulation resistance (3.6.2), contact resistance (3.6.5), and air leakage requirements (3.6.3).

3.6.17 Compression. There shall be no evidence of breakage or distortion following the test specified in 4.9.19.

3.6.18 Impact resistance of shell body. There shall be no evidence of breakage or distortion following the test specified in 4.9.20.

3.7 Marking. Connectors are to be marked in accordance with method I of MIL-STD-1285, and are to include the PIN (see 3.1), the manufacturer's name or code symbol, and date code. The marking shall remain legible after completion of the tests specified herein.

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3.8 Workmanship. Connectors and accessories shall be processed in such a manner, as to be uniform in quality and shall be free from defects. There shall be no evidence of poor molding, fabricating, cracking of insulator after molding or improperly assembled contacts, peeling or chipping of the plating or finish, nicks and burrs of metal parts surfaces. The contacts shall be free from such burrs or sharp corners that would damage the plating of mating connectors. The wire barrel ends shall be free from such burrs or sharp corners that would damage or cut wires.

## 4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.4).
- b. Verification of qualification (4.7).
- c. Conformance inspection (see 4.8).

4.2 Inspection conditions. Unless other wished specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-1344 and MIL-STD-202.

4.2.1 Verification testing. The following identified tests and test methods assure connector integrity within typical operating conditions and applications. The use of alternate commercial industry standard test methods is allowed, however when an alternate method is used, the alternate method must be coordinated with the qualifying activity prior to performance of the test. The test methods described herein are proven methods and shall be the referee method in cases of dispute.

4.2.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy qualify and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment (i.e. ANSI/NCSL Z540.1, or ISO 10012-1 part 1) shall be required.

4.2.1.2 Automatic testing. The inspection for insulation resistance and dielectric withstanding voltage may be performed by automatic means, except during qualification testing. Insulation resistance and dielectric withstanding voltage may be performed simultaneously in less than one minute provided that the current flow in the circuit is zero before automatically proceeding to the next step. In addition, automatic test equipment shall be manually reset when failure occurs.

4.2.3 Responsibility for compliance. All items shall meet all requirements of sections 3 and 4. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials, as specified in 3.3.3 and on the specification sheets (see 3.1), used in the fabricating the connectors, are in accordance with the applicable specifications or performance requirements prior to such fabrication (see 3.3, 4.9.2, and 6.2).



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4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3.1) on sample units produced with equipment and procedures normally used in production. Use of alternate materials, plating, and processes (see 3.3.1) shall be identified for inclusion in the product test documentation.

4.5 Test conditions.

4.5.1 Test fixture. Connector test samples can be mated with a test fixture unit to perform electrical testing provided all applicable test conditions are maintained.

4.5.2 Preconditioning. The contractor shall be permitted to precondition the connector samples prior to performing any electrical tests. The preconditioning shall consist of removing surface moisture from the connectors by wiping, drying, blowing, or heating. The application of heat shall be limited to 3 minutes. For unmated connectors subjected to immersion and humidity test, a 24-hour waiting period in an ambient room temperature with a relative humidity of 50  $\pm$  5% is permitted.

4.6 Preparation of samples. Preparation of samples for immersion, air leakage, and humidity testing.

- a. Connector plug. The cable entry shall be sealed with a solid rubber plug having a length of approximately 6 inches (15.24 cm) and a diameter within + .005 inch (0.13 mm) of the minimum cable size specified in the individual specification sheets.
- b. Connector receptacle. Connector receptacle shall be mounted using the normal mounting method so that only the front face is exposed to the water.

4.6.1 Sample size. Nine completely assembled plugs and receptacles from each specification sheet to be qualified shall be subjected to qualification inspections. Connector pairs shall be as specified in table II.

TABLE II. Mating characteristics.

Plug <u>1/</u>	Mating receptacle
M55181/1	M55181/2-01
M55181/3	M55181/4-01
M55181/5	M55181/6-01
M55181/7	M55181/8-01

1/ For dash numbers -01 through -05, inclusive.

4.6.2 Inspection routine. Sample connectors shall be subjected to the inspections specified in table III.

4.6.3 Failures. Failure to pass any one of the tests in table III shall be cause for refusal to grant qualification. All failures shall be attributed to the cause for refusal to grant qualification. All failures shall be attributed to the connector unless data is provided showing failure is due to the cable or test fixture.

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TABLE III. Qualification inspection.

Inspection	Requirement paragraph	Method paragraph	Group (pairs) 1/								
			1	2	3	4	5	6	7	8	9
Visual and mechanical	3.1, 3.3, 3.4, 3.7, and 3.8	4.9.2	U	U	U	U	U	U	U	U	U
Dielectric withstanding voltage (sea Level)	3.6.1	4.9.3.1	U	U	U	U	U	U	U	U	U
Insulation resistance	3.6.2	4.9.4	U	U	U	U	U	U	U	U	U
Air leakage	3.6.3	4.9.5	U	U	U	U	U	U	U	U	U
Interchangeability	3.6.4	4.9.6	U	U	U	U	U	U	U	U	U
Contact resistance	3.6.5	4.9.7	M	M	M	M	M	M	M	M	M
Dielectric withstanding voltage (High altitude)	3.6.1	4.9.3.2	U	U	U	U	U	U	U	U	U
Humidity	3.6.6	4.9.8	U	M	---	---	---	---	---	---	---
Insert strength	3.6.7	4.9.9	M	M	M	---	---	---	---	---	---
Contact retention	3.6.8	4.9.10	M	M	M	---	---	---	---	---	---
Temperature cycling	3.6.9	4.9.11	M*	U	U	---	---	---	---	---	---
Durability	3.6.10	4.9.12	M	M	M	---	---	---	---	---	---
Impact resistance of nose piece	3.6.11	4.9.13	U	U	U	---	---	---	---	---	---
Vibration	3.6.12	4.9.14	---	---	---	M	M	M	---	---	---
Salt spray	3.6.13	4.9.15	---	---	---	U	U	U	---	---	---
Immersion	3.6.14	4.9.16	---	---	---	---	---	---	M*	U	U
Bounce	3.6.15	4.9.17	---	---	---	---	---	---	M	M	M
Drop	3.6.16	4.9.18	---	---	---	---	---	---	M	M	M
Compression	3.6.17	4.9.19	---	---	---	---	---	---	UP	UP	UP
Impact resistance body Shell	3.6.18	4.9.20	---	---	---	---	---	---	UP	UP	UP

1/ M - Mated plug and receptacle

U - Unmated plug and receptacle.

M\* - For purposes of qualification inspection the three samples shall be arranged as follows: one mated and two unmated

UP - Unmated Plug.

4.7 Verification of qualification. To retain qualification, the contractor shall verify in coordination with the qualifying activity the capability of manufacturing products, which meet the performance requirements of this specification. Refer to the qualifying activity for the guidelines necessary to retain qualification to this particular specification. The contractor shall immediately notify the qualifying activity at any time that the inspection data indicates failure of the qualified product to meet the performance requirements of this specification.

#### 4.8 Conformance inspection.

4.8.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection. Except as specified in 4.8.7, delivery of products which have passed the group A inspection shall not be delayed pending the results of group B inspection.

4.8.2 Inspection lot. An inspection lot shall consist of all the connectors, counterpart receptacles, and plugs as indicated in each specification sheet, produced under essentially the same conditions and offered for inspection at one time.

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4.8.3 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table IV, and shall be made on the same set of sample units in the order shown.

4.8.3.1 Sampling plan (group A). Table IV tests shall be performed on a production run basis. Samples shall be selected in accordance with table V. If one or more defects are found, the lot shall be screened for that particular defect and defects removed. A new sample of parts shall be selected in accordance with table IV and all group A tests shall be performed again. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE IV. Group A inspection.

Inspection	Requirement paragraph	Method paragraph
Visual and mechanical examination	3.1, 3.3, 3.4, 3.7, and 3.8	4.9.2
Dielectric withstanding voltage (sea level)	3.6.1	4.9.3.1
Insulation resistance	3.6.2	4.9.4
Air leakage	3.6.3	4.9.5
Immersion	3.6.14	4.9.16

TABLE V Lot and sample size.

Lot size			Samples
1	to	3	all
4	to	25	3
26	to	50	5
51	to	90	6
91	to	150	7
151	to	280	10
281	to	500	11
501	to	1,200	15
1,201	to	3,200	18
3,201	to	10,000	22
10,001	to	over	29

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4.8.4 Retention of qualification. To retain qualification, the contractor shall make available upon request the following reports to the qualifying activity, at the time intervals specified:

- a. 12 month intervals. A summary of the results of both group A and group B tests performed for inspection of product for delivery, indicating as a minimum the number of lots that have passed and the number that have failed. The results of all reworked lots shall be identified and accounted for.
- b. 24 or 36 month intervals. A summary of the results of group C tests performed for qualification inspection, including the number and mode of failures. If the summary of the test results indicates nonconformance with the specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list (QPL).

4.8.5 No production. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during 2 consecutive reporting periods, there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the products to testing in accordance with the qualifying inspection requirements.

4.8.6 Rejected lots. If an inspection lot is rejected, the manufacturer may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using the sample size of the next higher lot size specified in table V and shall not thereafter be tendered for acceptance unless the former rejection or requirement of correction is disclosed. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4.8.7 Disposition of sample units. If the lot is accepted, unwired samples may be delivered on the contract. The wired samples with removable contacts may be delivered on the contract provided the wired contacts are replaced with new contacts.

4.8.8 Group B inspection. Group B inspection shall consist of the tests specified in table VI, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection.

TABLE VI. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Contact resistance	3.6.5	4.9.7
Contact retention	3.6.8	4.9.10
Interchangeability	3.6.4	4.9.6

4.8.8.1 Sampling plan. Samples shall be selected in accordance with table V. Connectors shall be selected at random from production units. These inspections shall be performed at least once every 12 months.

4.8.8.2 Failures. No failures shall be allowed.

4.8.8.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

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4.8.8.4 Disposition of sample units. Sample units, which have been subjected to group B inspection, are deliverable on the contract or purchase order.

4.8.9 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 6.3), delivery of products which have passed groups A and B shall not be delayed pending the results of these periodic inspections.

4.8.9.1 Group C inspection. Group C inspection shall consist of the tests specified in table VII, in the order shown. Group C inspection shall be made on sample units selected from inspection lots, which have passed the groups A and B inspection.

TABLE VII. Group C inspection.

Inspection	Requirements paragraph	Method paragraph	Number of sample pairs
Humidity	3.6.6	4.9.8	2
Insert strength	3.6.7	4.9.9	2
Temperature cycling	3.6.9	4.9.11	2
Durability	3.6.10	4.9.12	2
Impact resistance of nose piece	3.6.11	4.9.13	2
Vibration	3.6.12	4.9.14	2
Salt spray	3.6.13	4.9.15	2
Bounce	3.6.15	4.9.17	2
Drop	3.6.16	4.9.18	2
Compression	3.6.17	4.9.19	2
Impact resistance of shell body	3.6.18	4.9.20	2

4.8.9.2 Sampling plan. For group C inspection, two mated pairs with the greatest number of contacts from each specification sheet, of qualified connectors shall be selected at random from units produced within twelve (12) months preceding initial reporting date, and every thirty-six (36) months thereafter. When necessary for inspection purposes, the manufacturer shall supply counter part plugs or the receptacles. Two mated sample connectors shall be subjected to each subgroup in table VII.

4.8.9.3 Failures. If one or more sample units fail to pass group C inspection, the entire lot shall be considered to have failed.

4.8.9.4 Disposition of sample units. Sample units, which have been subjected to group C inspection, shall not be delivered on the contract or purchase order.

4.8.9.5 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

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4.9 Methods of inspection.

4.9.1 Test methods. The following identified tests and test methods assure socket integrity within typical operating conditions and applications. Alternate commercial industry stand test methods are allowed, however when and alternate method is used, the qualifying activity must be notified prior to performance of the test. The test methods described herein are proven methods and shall be the referee method in cases of dispute.

4.9.2 Visual and mechanical inspection. The connectors, accessories and piece parts shall be examined to verify that the dimensions, materials, design construction, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.7, and 3.8).

4.9.3 Dielectric withstanding voltage (see 3.6.1).

4.9.3.1 At sea level (see 3.6.1). The mated connectors shall be tested in accordance with method 3001 of MIL-STD-1344. The following details shall apply:

- a. Points of application: The test voltage specified in table I shall be applied between each contact of the unmated connector with the remaining contacts connected together and to the shell.
- b. The voltage shall be applied at a rate of approximately 500 volts (RMS or DC) per second until specified voltage is reached. Voltage shall be maintained for 60 +10, -0 seconds, and the connectors shall meet the requirements of 3.6.1.

4.9.3.2 At altitude (see 3.6.1). The connectors shall be tested in accordance with method 3001 of MIL-STD-1344. The following details shall apply:

- a. Special preparations or conditions: Unless otherwise specified (see 3.1), connectors shall be tested as specified in 4.9.3.1, while being maintained at a barometric pressure simulating an altitude of 50,000 ft (15.24 Km) (i.e. 87 torr).
- b. The voltage for 50,000 ft (15.24Km) listed in table I shall be applied as described in 4.9.3.1 and the connector shall meet the requirements of 3.6.1.

4.9.4 Insulation resistance (see 3.6.2). When tested as specified in MIL-STD-1344, method 3003, the connectors shall meet the requirements specified in 3.6.2

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4.9.5 Air leakage (see 3.6.3). Connectors shall be prepared for test as indicated in 4.6. Air pressure of 2.5 pounds per square inch (psi) (17.2 kilopascal) shall be applied to the contact face and then to the rear of the plug or receptacle, using the differential leakage tester as shown on figure 1 the following details apply:

- a. The connector shall be attached to the leakage tester with its face against the appropriate jig of the leakage tester.
  - (1) With differential gage bypass valve open, the line valve and regulator shall be adjusted to apply 2.5 psi (17.2 kilopascal) to the connector face.
  - (2) After 15 seconds minimum the line valve shall be closed.
  - (3) Then the differential gage bypass valve shall be closed and the differential gage observed for not less than 30 seconds for a continuous change in the level of the two columns (a small momentary change when the bypass valve is closed is not evidence of leakage).
  - (4) The bypass valve shall then be opened before removal of the connector.
- b. After completion of the above, the rear of the connector shall be attached to the proper jig and the test repeated.
- c. After completion of the above, the face of the connector shall be attached to the appropriate jig of the tester, and the mating seal shall be tested by applying a differential pressure of 2.5 psi (117.2 kilopascals) to the seal lip around the contact face and repeating the test.
- d. Connectors shall meet the requirements specified in 3.6.3.

Note: The use of water to visually indicate air leakage is also acceptable.

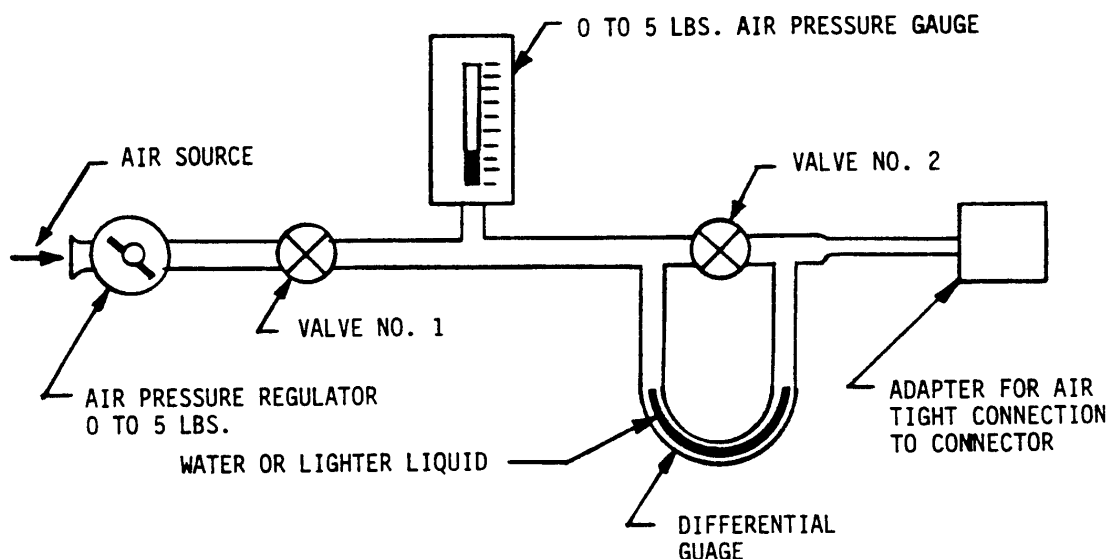


FIGURE 1. Diagram of air pressure test set up.

4.9.6 Interchangeability (see 3.6.4). For initial qualification testing, the dimensions shall be gauged, using gages as specified in the applicable specification sheet to determine conformance to the physical interchangeability requirements of 3.6.4. For group B inspection the dimensional call outs in the individual specification sheets or the use of gages shall be used.

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4.9.7 Contact resistance (see 3.6.5). The connector under test and a test fixture mating connector shall meet the interchangeability requirements of 3.6.4 relative to the mating dimensions. The following conditions shall apply:

- a. The connectors shall be mated and a test current specified in table VIII shall be applied between corresponding terminals.
- b. The voltage drop across the mating contact terminals shall then be measured using the voltmeter-ammeter method or equivalent.
- c. The combined error to the measurement shall not exceed 5 percent.
- d. The connectors shall meet the requirements of 3.6.5.

TABLE VIII. Contact resistance current.

Contact size AWG	Current rating amps
12	35
20	7.5
20	7.5

4.9.8 Humidity (see 3.6.6). After being prepared for test as specified in 4.6, 50 percent of the connectors shall be mated and 50 percent shall be unmated. The connectors shall be tested in accordance with method 1002, type II of MIL-STD-1344, except steps 7a and 7b shall not be required. The connectors shall meet the requirements of 3.6.6.

4.9.9 Insert strength (see 3.6.7). The connector shall be securely mounted and shall be tested with the applicable test connector as specified in the axial force 4.9.9.1, radial torque 4.9.9.2 and torque 4.9.9.3. The connectors shall meet the requirements of 3.6.7.

4.9.9.1 Axial force.

- a. A force parallel to the axis of the receptacle, increasing from 0 to 400 pounds (0 to 181.4 kg) in not less than 10 or more than 20 seconds shall be applied for a period of 1 minute.
- b. The force shall be applied first against the front and then the rear of the insert.
- c. A pull of 400 pounds (181.4 kg) shall then be applied to the center coupling threaded part.

4.9.9.2 Radial torque.

4.9.9.2.1 Connector plugs. A test receptacle shall be mated with the plug under test.

A gradually increasing radial torque shall be applied until 150 lbf in (17 N m) is reached, and shall be maintained for a period of 1 minute.

4.9.9.2.2 Connector receptacles. The test shall be performed as specified in 4.9.9.2.1, except that the test connector plug shall be mated with the receptacle under test.

4.9.9.3 Torque. The complete test plug shall be mated with the receptacle under test. The following conditions shall apply:

- a. A gradually increasing torque shall be applied to the test connector plug by means of a lever attached to the cable entry, until a torque of 150 lbf in (17 N m) is reached.
- b. The torque shall be maintained for a period of 1 minute, and shall be applied both axially and radially.



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4.9.10 Contact retention (see 3.6.8). Connectors shall be tested in accordance with method 2007 of MIL-STD-1344. The following details shall apply:

- a. Sample connector with all contacts in place and insert mounted in the shell.
- b. Axial load: Applied uniformly at a rate of approximately one pound per second (454 grams/sec).
- c. Axial direction: Shall be applied in both directions, first one direction then the opposite direction.
- d. The contacts shall meet the requirements of 3.6.8.

4.9.11 Temperature cycling (see 3.6.9). Connectors shall be tested in accordance with method 1003 of MIL-STD-1344. The following details shall apply:

- a. Test connectors: Half of the connectors shall be mated.
- b. Test condition letter: A.
- c. Measurements after mating: During the last 5 minutes of each exposure in the fifth cycle:
  - (1) Unmated connectors shall be mated and checked for contact resistance (see 3.6.5) and then unmated.
  - (2) Mated connectors shall be checked for contact resistance.
- d. Forty-five minutes after the end of the fifth cycle, all connectors shall be subjected to the mating and unmating operation at least once.
- e. Following the test the connectors shall meet the requirements of 3.6.9.

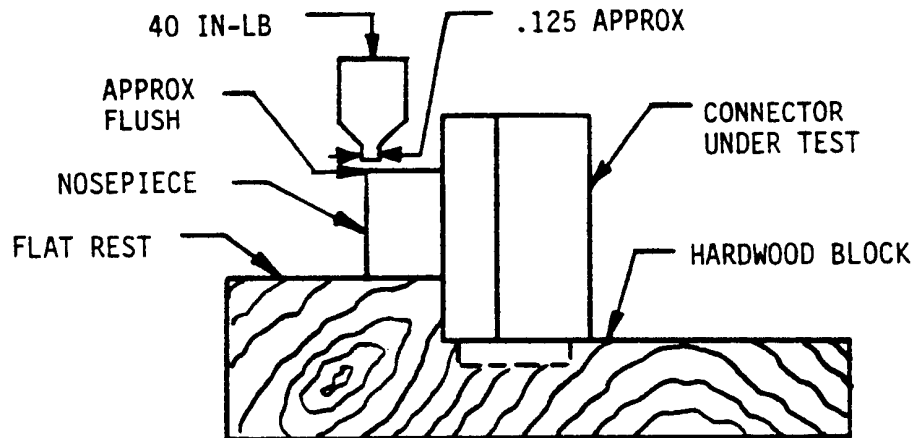
4.9.12 Durability (see 3.6.10). The connectors shall be tested in accordance with method 2016 of MIL-STD-1344. The connector assemblies shall be subjected to 500 cycles of mating and unmating at a rate not to exceed 300 cycles per hour. The mating and unmating shall be accomplished so that the plug and receptacle are completely separated during each cycle. The following details shall apply:

- a. For each coupling, a torque of  $12 \pm 1$  inch-pounds (1.36 Nm) shall be applied to the wing blade in the direction of the direction to tighten.
- b. During the final coupling, the torque shall be maintained for at least 1 minute.
- c. Connectors shall meet the requirements of 3.6.10.

4.9.13 Impact resistance nose piece (see 3.6.11). The following conditions shall apply:

- a. The connector and plug under test shall be securely mounted to a hardwood block and subjected to a traverse blow of 40 inch-pounds (4.52 Nm). A weight of 2 pounds (907 grams) falling freely through a height of 20 inches (50.8 cm).
- b. Two blows shall be delivered by a flat, blunt object, approximately 1/8 inch (3.17 mm) wide; on to the polarizing groove and the other at a point of 180 degrees from the polarizing groove in the vicinity of the mating edge (see figure 2).
- c. The connectors shall meet the requirements of 3.6.11.

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FIGURE 2. Impact resistance of nose piece test set-up.

4.9.14 Vibration (see 3.6.12). Mated connectors shall be tested in accordance with method 2005 test condition I of MIL-STD-1344. The following details shall apply:

- a. Method of mounting. Receptacles shall be rigidly installed on a bracket by means of the receptacle mounting flange and nut. Plugs shall be fully mated to an appropriate mating receptacle.
- b. Duration and direction of motion: Two hours in each of three mutually perpendicular directions. One direction shall be with the contact axis in a horizontal plane.
- c. Tests and measurements after vibration: The connectors shall meet the requirements of 3.6.12.

4.9.15 Salt spray (corrosion) (unmated) (see 3.6.13). Connectors shall be tested in accordance with method 1001 of MIL-STD-1344. The following details shall apply:

- a. Test condition: B.
- b. The samples shall not be mounted, but shall be suspended using wax twine (or string), glass rods, or glass cord.
- c. The connectors shall meet the requirements of 3.6.13.

4.9.16 Immersion (see 3.6.14). The following conditions shall apply:

- a. After being prepared for test as indicated in 4.6, the connectors shall be immersed in tap water or deionized water to a depth of 6 feet (1.83 meters) for a period of 48 hours.
- b. 50 percent of the connectors tested shall be mated and 50 percent shall be unmated.
- c. Following the test, the connectors shall meet the requirements of 3.6.14.

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4.9.17 Bounce (see 3.6.15). The connectors shall be tested on Package Tester. Examples of packing testing tables meeting these requirements include model Type 1000SC or 100V, as made by the L. A. B. Equipment, Inc., Skaneateles, New York, or equivalent. Accessories shall be selected from those listed on drawing SC-A-46439. The following details apply:

- a. Cover the tester bed with a panel of 1/2 inch (12.70 mm) plywood, with the grain parallel to the drive chain. Space sixpenny nails with heads below the surface, at 6 inch (152 mm) around all four edges at 3 inch (76 mm) intervals in a 6 inch (152 mm) square in the center.
- b. Place the mated connectors on the bed of the package tester. Limit the lateral motion by wooden fences, to not more than 3 inches (76 mm) and not less than 1 inch (25.4 mm).
- c. Operate the package tester, shafts in phase, for a total of 3 hours at  $284 \pm 2$  rpm.
- d. Following the above, the connector shall meet the requirements of 3.6.15.

4.9.18 Drop (see 3.6.16). The connectors shall be dropped at random six times from a height of 6 feet (1.83 m) onto a 2 inch (50.80 mm) wood floor or barrier backed by a concrete or rigid steel frame. The connectors shall meet the requirements of 3.6.16

4.9.19 Compression (see 3.6.17). The shell body of the connector plug shall be subjected to a force of 500 pounds (227 kg) applied as shown on figure 3. The connectors shall meet the requirements of 3.6.17.

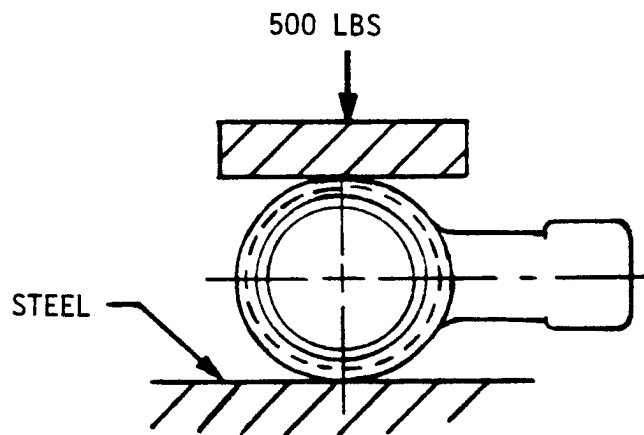
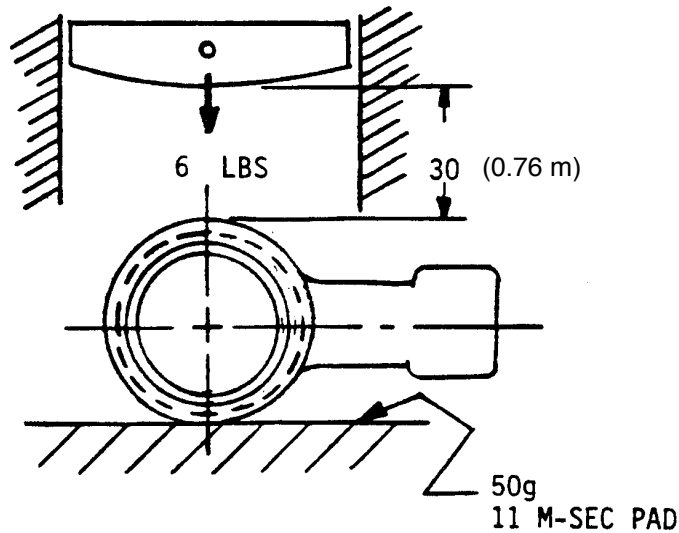


FIGURE 3. Compression test of shell.

4.9.20 Impact resistance of shell body (see 3.6.18). The shell body of the connector plug shall be subjected to a force of 180 inch-pounds (20.3 Nm) applied as shown on figure 4. The connectors shall meet the requirements of 3.6.18

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FIGURE 4. Impact resistance of shell body test set up.

#### +5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 3.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

#### 6. NOTES

(This section contains information of a general or explanatory nature, which may be helpful, but is not mandatory.)

6.1 Intended use. The electrical connectors covered by this specification are used primarily for portable and vehicular mounted equipment.

6.1.1 Military unique rationale. The connectors covered by this specification are military unique because they must be able to function after 500 hours of salt spray, operate at  $-55^{\circ}$  to  $+200^{\circ}$  C, and withstand barometric pressure drops from 50,000 feet (15.24 km) to sea level. Commercial electronic connectors are not designed to withstand such extreme and sudden environmental conditions and would experience catastrophic failure.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of the specification.
- b. Title, number and date of the applicable specification sheet, and the complete PIN (see 1.2.1 and 3.1).
- c. Certificate of compliance covering materials, when required.
- d. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and 2.2).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No 55181 whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus (DSCC-VQP), 3990 East Broad Street, Columbus, Ohio 43216-5000. Application for qualification tests will be made in accordance with "Provisions Governing Qualification" (see 6.3.1).

6.3.1 Provisions governing qualification. Copies of "Provisions Governing Qualification" may be obtained upon application to Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

6.4 Cross reference.

## 6.4.1 The old connector designator was in the following form:

<u>MW</u>	<u>10</u>	<u>M</u>	<u>(M)</u>	<u>A</u>	<u>11</u>
Connector	Shell	Insert	Contact	Insert	Cable size
type	type	type	type	arrangement	accommodation
(6.4.1.1)	(6.4.1.2)	(6.4.1.3)	(6.4.1.4)	(6.4.1.5)	(6.4.1.6)

6.4.1.1 Connector type. Connectors covered by this specification were identified by two letter symbols "MW".

6.4.1.2 Shell type. The shell type was identified by a two digit number; plugs by the number "10" and receptacles by the number "20".

6.4.1.3 Insert type. The insert type was identified by a single letter; male contacts by the letter "M" and female contacts by the letter "F".

6.4.1.4 Contact type. The contact type was identified by a single letter in parenthesis; molded contacts by "M".

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6.4.1.5 Insert arrangements. The insert arrangements were identified by a single letter as shown in table IX.

TABLE IX. Insert characteristics.

Insert arrangement	Number of contacts	Contact size AWG	Current rating amps
A	4	12	35
B	9	20	7.5
D	18	20	7.5

6.4.1.6 Cable size accommodation. The cable size accommodation was identified by a two-digit number as shown in table X. This number indicated the maximum outside diameter of the cable.

TABLE X. Cable size accommodation.

Symbol	Minimum (mm)	Maximum (mm)
00	Not applicable	Not applicable
11	.292 (7.41)	.343 (8.71)
13	.323 (8.20)	.406 (10.31)
15	.386 (9.80)	.468 (11.88)
17	.448 (11.38)	.531 (13.48)
19	.511 (12.98)	.593 (15.06)

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs. Table XI lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. If any of these hazardous materials are required, it is recommended that it be used only when other materials cannot meet performance requirements.

TABLE XI. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and compounds	Lead and compounds	Toluene
Carbon Tetrachloride	Mercury and compounds	1,1,1 - Trichloroethane
Chloroform	Methyl Ethyl compounds	Trichloroethylene
Chromium and compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and compounds	Nickel and compounds	

6.5 Keyword listing.

Beryllium  
Center coupling  
Copper  
Lead  
Nickel  
Wing blade

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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CONCLUDING MATERIAL

Custodians:

Army - CR

Navy - EC

Air Force - 11

DLA - CC

Preparing activity

DLA - CC

(Project 5935-4340-000)

Review activity:

Air Force - 99

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

## I RECOMMEND A CHANGE:

**1. DOCUMENT NUMBER**  
**MIL-DTL-55181D**

**2. DOCUMENT DATE (YYYYMMDD)**  
**20030612**

**3. DOCUMENT TITLE**

CONNECTORS, PLUG AND RECEPTACLE, INTERMEDIATE POWER (ELECTRICAL, WATERPROOF), TYPE MW, GENERAL SPECIFICATION FOR

**4. NATURE OF CHANGE** (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

**5. REASON FOR RECOMMENDATION****6. SUBMITTER**

a. NAME (*Last, First, Middle Initial*)

b. ORGANIZATION

c. ADDRESS (*Include zip code*)

d. TELEPHONE (*Include Area Code*)

(1) Commercial

(2) DSN

(*if applicable*)

7. DATE SUBMITTED  
(YYYYMMDD)

**8. PREPARING ACTIVITY**

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**Defense Supply Center, Columbus**

b. TELEPHONE (*Include Area Code*)

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(2) DSN **850-0573**

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